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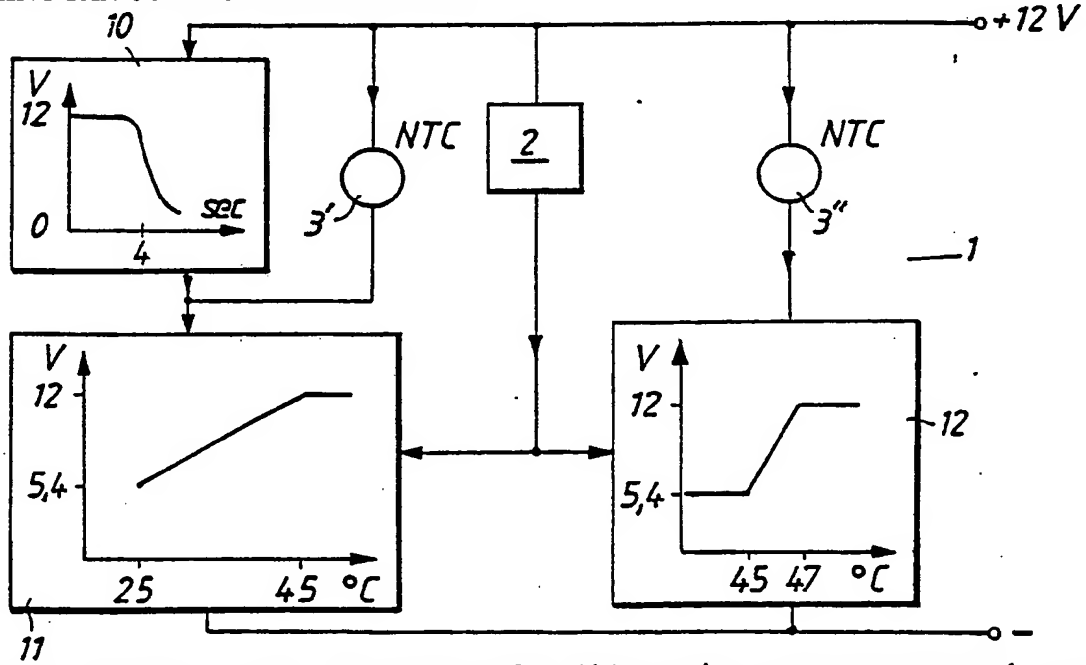

(57) Abstract

A control device for controlling a personal computer cooling fan, which comprises a temperature sensor and a control circuit intended to supply the fan with a voltage in response to a signal received from the temperature sensor. The invention is characterized by the combination that the control circuit (1) is intended, when the personal computer concerned is switched on, to supply the fan (2) with a voltage which is higher than its idling voltage over a limited, predetermined period of time, and that the control device (1) has a dimension of at highest about 4 x 3 cm and a thickness of at most about 1 cm, thereby enabling the device to be placed in the housing (5) of the fan (2); and in that provided between the control circuit (1) and the sensor body (6) of the temperature sensor (3) is a rigid electric conductor (7') having a length sufficient to enable the sensor body (6) to be placed in the airflow through the fan (2).

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A Cooling Fan Control Arrangement

The present invention relates to a control arrangement for personal computer cooling fans. The invention is primarily concerned with a control arrangement which can be subsequently fitted to existing personal computers.

Practically all personal computers are equipped with a cooling fan which sucks air from the computer interior and blows the air out through the computer casing. Cooling fans are necessary in order to cool the electronic devices of the computer and to prevent these devices from becoming overheated, which may result in damage to the computer.

The majority of known personal computers are fitted with relatively powerful fans, so that the computer will be cooled even under conditions in which the ambient temperature is relatively high. The internal temperature of the computer should not exceed approximately 50°C.

The fan will thus constantly create noise which although slight is felt to be extremely irritating by some people. This is amplified by the fact that the office space in which people work with personal computers is otherwise often relatively quiet.

It is therefore desirable to control the fan so that it will operate at a speed which is sufficient to achieve satisfactory cooling of the computer. Devices are known which include a temperature sensor and an electronic control circuit which is intended to control the fan voltage in response to temperature. The device is intended to be fitted subsequently to existing personal computers.

However, the known device is encumbered with several decisive drawbacks. One drawback is that the fan remains completely stationary at temperatures beneath 24°C and at a temperature of 24°C a low idling voltage is applied to the fan, which may mean that the motor and fan starting-torque is not reached until the temperature that prevails is

considerably higher than 24°C, i.e. the temperature at which a higher voltage is applied to the motor. Another drawback is that the device is not constructed so that its temperature sensing element is able to sense the mean temperature of the exhaust air from the computer. The working of the control circuit is, in fact, dependent on the position of the device in the computer.

The problem is solved by the present invention, which provides a highly reliable control device.

Accordingly, the present invention relates to a control device for controlling a pesonal computer cooling fan, said device including a temperature sensor and a control circuit which is intended to apply a voltage to the fan in response to a signal from the temperature sensor, and is characterized by the combination that the control circuit is constructed to apply a higher voltage to the fan than its idling voltage for a limited predetermined period of time when the computer is switched on; in that the control device has a dimension of at most 4 x 3 cm and a thickness of at most 1 cm, thereby enabling the device to be placed in the fan housing; and in that there is provided between the control circuit and the sensor body of the temperatur sensor a rigid electric conductor having a length sufficient to enable the sensor body to be placed in the airflow through the fan.

The invention will now be described in more detail, partly with reference to an exemplifying embodiment of the invention illustrated in the accompanying drawing, in which

- Figure 1 is a block schematic illustrating the inventive device;
- Figure 2 is an example of a circuit diagram;
- Figure 3 illustrates a personal computer fan seen from one side and fitted with a control device according to the invention; and
- Figure 4 is a view of a personal computer fan seen immediately from the front and fitted with an inventive control device.

Figures 3 and 4 illustrate a control device 1 for controlling a personal computer cooling fan 2. The control device 1 includes a temperature sensor 3 and a control circuit which is constructed to apply a voltage to the fan 2 in response to a signal received from

the temperature sensor 3. The sensor 3 is intended to be placed in the airflow constituting fan exhaust air 4, i.e. the air that the fan has withdrawn from the computer by suction. The reference numeral 7 in Figures 3 and 4 identifies fan blades.

The inventive control device 1 has a dimension of at most about 4 x 3 cm and a thickness of at most about 1 cm, thereby enabling the device to be placed in the fan housing 5. Extending between the control circuit 1 and the temperature sensor body 6 is a rigid electric conductor 7' whose length is sufficient to enable the sensor body 6 to be placed in the flow of air passing through the fan 2.

This is an essential feature of the invention, since it will enable the sensor body 6 of the temperature sensor to detect a mean temperature in the computer while, at the same time, rendering it unimportant as to where the control circuit 1 itself is located. Although the control circuit is constructed so that it can be placed in the fan housing 2, there is nothing to prevent the circuit from being placed in some other location, provided that the sensor body 6 can be placed in the airflow.

Furthermore, in accordance with the invention, when the personal computer concerned is switched on, the control circuit 1 will function to apply a higher voltage to the fan 2 than its idling voltage for a limited, predetermined period of time. A starting circuit 10 belonging to the control circuit is provided to this end, see Figure 1.

According to one preferred embodiment, the starting circuit 10 is constructed to activate or drive the fan 2 with full voltage, namely 12 V, over a period of about 2 to 10 seconds, preferably 4 seconds, when the computer is first switched on.

This is a very important feature of the device. Firstly, the user hears that the fan is working. If the fan does not work, the computer will overheat with the possible result of serious and expensive damage occurring. Secondly, the device overcomes any starting difficulties that the fan may have in the form of starting torque in those instances when the fan is first started with an idling voltage of, for instance,

5 V.

It will be seen from Figure 1 that when the personal computer is switched on, the starting circuit applies a voltage of 12 V to the fan 2. This voltage falls after a time lapse of 4 seconds. This is effected with the aid of a time circuit which includes an RC-circuit, see Figure 2, where the starting circuit includes those components shown within the broken line area 13.

A control circuit 11 included in the control circuit 1 is constructed to then activate the fan 2 in response to the signal from the temperature sensor 3. This control circuit begins to function when the starting circuit 10 has lowered the voltage to the fan.

According to one preferred embodiment, the control circuit 11 is constructed to activate or drive the fan in response to temperature, preferably in accordance with a linear relationship within a temperature range of about 25°C and 45°C, and to activate or drive the fan at full voltage at temperatures thereabove, i.e. at a voltage of about 12 V, and to activate the fan with a low idling voltage, for instance a voltage of about 5 V, at temperatures beneath 25°C. This is shown in Figure 1, where the idling voltage is set to 5.4 V.

When the idling voltage is applied, the fan will rotate so slowly as not to be heard in practice. The fan is then regulated to work at the lowest necessary speed at which the personal computer is sufficiently cooled. This means that the sound generated is far less than is normal in present-day computers when the fan constantly operates at full power.

According to another preferred embodiment, the control circuit includes a separate safety circuit 12 which is intended to come into operation at a temperature of about 45°C and to immediately activate the fan with full voltage at a temperature above 47°C. At temperatures between 45°C and 47°C, the safety circuit preferably activates the fan linearly, as shown in Figure 1.

Figure 2 illustrates the components that are included in the safety

circuit within the area referenced 14.

This circuit activates the fan irrespective of whether the control circuit 11 functions or not. To this end, the safety circuit 12 is connected to a separate temperature sensor 3". In Figure 1, the temperature sensor for the control circuit is referenced 3'. Both of the temperature sensors 3' and 3" may be placed at the end of the aforesaid rigid conductor.

Figure 2 illustrates an exemplifying circuit in which NTC designates the temperature sensors and T1, T2 and T3 designate transistors. The fan is referenced 2. In other respects, standard accepted symbols are used. The person skilled in this art will have no difficulty in dimensioning the components on the basis of the illustrated circuit in order to achieve desired control temperatures and times.

The inventive control circuit is coupled in series with the standard cables extending between voltage source and a fan which is already installed in a personal computer.

It will be evident from the aforegoing that the present invention solves the problems mentioned in the introduction and provides a highly reliable control device.

The invention has been described in the aforegoing with reference to an exemplifying embodiment thereof. It will be understood, however, that times and temperatures may be selected somewhat differently to what has been stated above. Furthermore, the purely electronic solutio can be achieved in some other way, without changing the function of th control device.

The present invention shall not therefore be restricted to the afore-described embodiments thereof, since modifications can be made within the scope of the following Claims.

Claims

1. A control device for controlling a personal computer cooling fan, said device including a temperature sensor and a control circuit which is constructed to apply a voltage to the fan in response to a signal from the temperature sensor, c h a r a c t e r i z e d by the combination that the control circuit (1) is intended, when the personal computer concerned is switched on, to supply the fan (2) with a voltage which is higher than its idling voltage over a limited, predetermined period of time, and that the control device (1) has a dimension of at highest about 4 x 3 cm and a thickness of at most about 1 cm, thereby enabling the device to be placed in the housing (5) of the fan (2): and in that provided between the control circuit (1) and the sensor body (6) of the temperature sensor (3) is a rigid electric conductor (7') having a length sufficient to enable the sensor body (6) to be placed in the airflow through the fan (2).

2. A device according to Claim 1, c h a r a c t e r i z e d by a starting circuit (10) which is included in the control circuit (1) and which is intended to activate the fan (2) with full voltage over a time period of about 2 to 10 seconds, preferably 4 seconds, when the computer is switched on, and by a regulating circuit (11) which is included in the control circuit (1) and which is intended to activate the fan in response to the signal from the temperature sensor (3).

3. A device according to Claim 1 or 2, c h a r a c t e r i z e d in that the control circuit (1) includes a separate circuit (12) which is intended to come into operation at a temperature of about 45°C and is constructed to immediately activate the fan at full voltage at temperatures above about 45°C.

4. A device according to Claim 1, 2 or 3, c h a r a c t e r i z e d in that the regulating circuit (11) is intended to control the fan in dependence on temperature, preferably in accordance with a linear relationship between a temperature range of about 25°C and 45°C and at temperatures thereabove to activate the fan (2) with full voltage,

i.e. about 12 V, and at temperatures therebeneath to activate the fan at a low idling voltage, for instance about 5 V.

Fig. 1

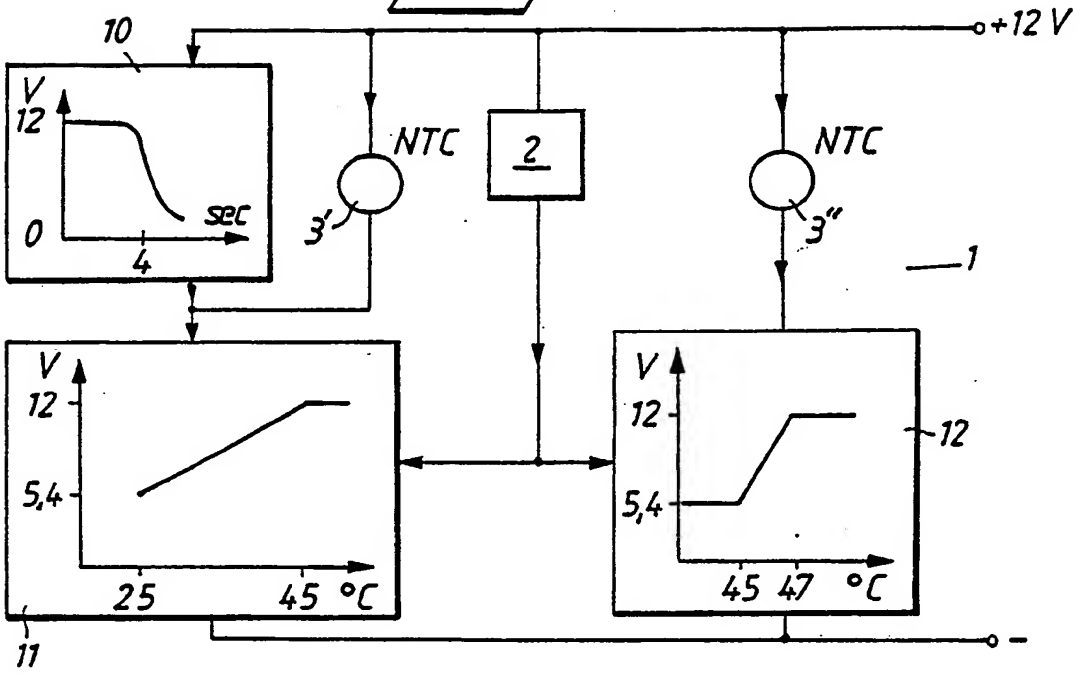


Fig. 2

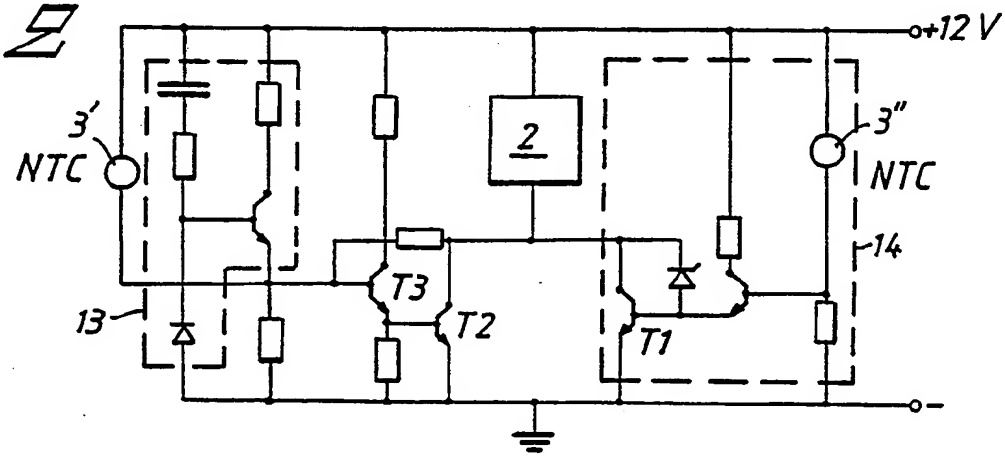


Fig. 3

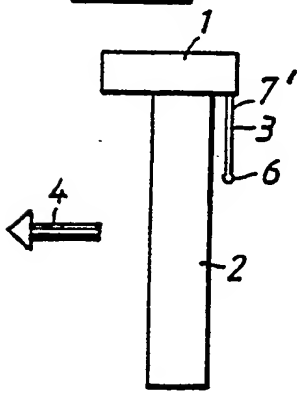
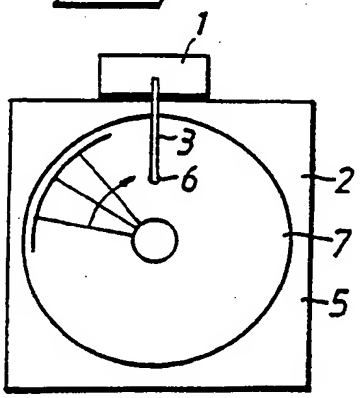


Fig. 4



INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 92/00414

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: G 05 D 23/19, G 06 F 1/20 // G 12 B 15/04, H 05 K 7/20

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	G 05 D, G 06 F, G 12 B, H 05 K

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
A	GB, A, 1568507 (COLAIR ELECTRONICS LIMITED ET AL) 29 May 1980, see page 1, line 52 - page 3, line 60; figure 1 --	1-4
A	US, A, 4806832 (R. MüLLER) 21 February 1989, see column 1, line 64 - column 2, line 61; column 3, line 59 - line 65; figures 1-2 --	1-4
A	EP, A1, 0090514 (ROTRON INCORPORATED) 5 October 1983, see abstract --	1-4

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
2nd September 1992	1992 -09- 14
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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.PCT/SE 92/00414

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the Swedish Patent Office EDP file on 31/07/92 The Swedish Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A- 1568507	80-05-29	NONE	
US-A- 4806832	89-02-21	DE-A- 3342031	84-05-24
EP-A1- 0090514	83-10-05	JP-A- 58162799	83-09-27